

## CLAIMS

What is claimed is:

1. A method of manufacturing a capacitor of a semiconductor device, the  
 5 method comprising:  
     forming a first electrode on a semiconductor substrate;  
     depositing a first dielectric layer on the first electrode;  
     curing the first dielectric layer in an atmosphere containing oxygen;  
     depositing a second dielectric layer on the cured first dielectric layer using only a  
 10 source gas without a reactant gas; and  
     forming a second electrode on the second dielectric layer without curing the  
     second dielectric layer.

2. The method as claimed in claim 1, wherein the first dielectric layer is  
 15 deposited using only a source gas without a reactant gas.

3. The method as claimed in claim 1, wherein the first dielectric layer and the  
 second dielectric layer are deposited using chemical vapor deposition.

20 4. The method as claimed in claim 1, wherein the first dielectric layer and the  
 second dielectric layer are deposited using atomic layer deposition.

5. The method as claimed in claim 1, wherein the source gas includes  
 oxygen atoms.

25 6. The method as claimed in claim 1, wherein the first dielectric layer and the  
 second dielectric layer are deposited at a temperature of 100 to 600 °C.

7. The method as claimed in claim 1, wherein the first dielectric layer is  
 30 deposited to a thickness of 5 to 200 Å, and the second dielectric layer is deposited to a  
 thickness of 5 to 3000 Å.

8. The method as claimed in claim 1, wherein the source gas is one of  $\text{Ta}(\text{OC}_2\text{H}_5)_5$ , tetra ethoxide tantalum-dimethyl amine ethoxide,  $\text{Ta}(\text{OsBu})_5$ ,  $\text{Ta}(\text{OC}_2\text{H}_5)_4(\text{acacC}_2\text{H}_5)$ ,  $\text{TaCl}_2(\text{OC}_2\text{H}_5)_2\text{C}_5\text{H}_7\text{O}_2$ , and  $\text{Ta}(\text{OCH}_3)_5$ .

5

9. The method as claimed in claim 1, wherein the first dielectric layer is formed of  $\text{Ta}_2\text{O}_5$  using chemical vapor deposition.

10

10. The method as claimed in claim 1, wherein the second dielectric layer is formed of  $\text{Ta}_2\text{O}_5$  using chemical vapor deposition.

11. The method as claimed in claim 1, wherein steps from depositing the first dielectric layer to depositing the second dielectric layer are performed in-situ in a single apparatus for forming dielectric layers.

15

12. The method as claimed in claim 1, wherein the atmosphere containing oxygen is an oxidative atmosphere containing  $\text{O}_2$  or  $\text{O}_3$ .

20

13. The method as claimed in claim 1, wherein the atmosphere containing oxygen is electron cyclotron resonance or an RF plasma of one of  $\text{O}_2$  and  $\text{N}_2\text{O}$ .

14. The method as claimed in claim 1, wherein the first electrode and the second electrode are formed of one of  $\text{TiN}$ ,  $\text{TaN}$ ,  $\text{W}$ ,  $\text{WN}$ ,  $\text{Al}$ ,  $\text{Cu}$ ,  $\text{Ru}$ ,  $\text{RuO}_2$ ,  $\text{Pt}$ ,  $\text{Ir}$ ,  $\text{IrO}_2$ , a doped polysilicon, and a combination thereof.

25

15. The method as claimed in claim 1, wherein the first dielectric layer and the second dielectric layer are formed of one of  $\text{Ta}_2\text{O}_5$ ,  $\text{HfO}_2$ ,  $\text{ZrO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{TiO}_2$ , and a combination thereof.

30

16. A method of manufacturing a capacitor of a semiconductor device, the method comprising:

forming a first electrode on a semiconductor substrate;  
depositing a first Ta<sub>2</sub>O<sub>5</sub> layer on the first electrode;  
curing the first Ta<sub>2</sub>O<sub>5</sub> layer in an O<sub>3</sub> atmosphere;  
depositing a second Ta<sub>2</sub>O<sub>5</sub> layer on the cured first Ta<sub>2</sub>O<sub>5</sub> layer using only

5 Ta(OC<sub>2</sub>H<sub>5</sub>)<sub>5</sub> without a reactant gas; and

forming a second electrode on the second Ta<sub>2</sub>O<sub>5</sub> layer without curing the second Ta<sub>2</sub>O<sub>5</sub> layer.

17. The method as claimed in claim 16, wherein the first Ta<sub>2</sub>O<sub>5</sub> layer is  
10 deposited using only Ta(OC<sub>2</sub>H<sub>5</sub>)<sub>5</sub> without a reactant gas.

18. The method as claimed in claim 16, wherein the first Ta<sub>2</sub>O<sub>5</sub> layer and the second Ta<sub>2</sub>O<sub>5</sub> layer are deposited using chemical vapor deposition.

19. An apparatus for forming a dielectric layer comprising:  
15 a loadlock chamber including a cassette for receiving a plurality of semiconductor substrates;

a transfer chamber including a robot arm connected to the loadlock chamber for loading and unloading a semiconductor substrate to and from the loadlock chamber;

20 a first deposition chamber connected to the transfer chamber for depositing a first dielectric layer on the substrate;

a curing chamber connected to the first deposition chamber; and

a second deposition chamber connected to the transfer chamber for depositing a second dielectric layer on the substrate,

25 wherein a first dielectric layer deposited in the first deposition chamber is cured in the curing chamber and then a second dielectric layer is deposited in the second deposition chamber.

20. The apparatus as claimed in claim 19, wherein dielectric layers are  
30 deposited using only a source gas without a reactant gas in the first deposition chamber and the second deposition chamber.